To:	EAHCP Implementing Committee Scott Storment, EAHCP Program Director
From:	EAHCP Science Committee Jacquelyn Duke, PhD, EAHCP Science Committee Chair
Date:	April 4, 2024
Re:	**EAHCP Science Committee Commentary on the Proposed Biological Goals and Objectives Under Consideration for Permit Renewal.**

Introduction

This memorandum is in response to a request from the Implementing Committee to understand the thoughts of the Science Committee on the Revised Biological Goals and Objectives (BGO) memorandum for the permit renewal process. Individuals from the Science Committee had the opportunity to review the BGO memorandum during the November-December 2023 review period open to all EAHCP Committee members. Implementing Committee members can view those individual comments in the appendix of the Revised BGO memorandum (version 2) sent to all EAHCP Committees on March 7, 2024. This memorandum from the Science Committee to the Implementing Committee does not cover individual Science Committee members' comments during the review process, but captures a synopsis of the Science Committee discussion of the BGO memorandum and presentation by Dr. Chad Furl and others at the March 7, 2024 Science Committee meeting. Additionally, version 2 was made available to the Science Committee members during the creation of this memorandum from the Science Committee to the Implementing Committee. Lastly, Science Committee members were given the opportunity to provide their comments on the BGO memorandum directly to the Implementing Committee. These comments as well as specific responses by SC members following the March 7 Science Committee meeting are attached as an Appendix to this memorandum.

The Permit Renewal team developing the BGO memorandum appears to have done reasonable due diligence in crafting the memorandum, as demonstrated by the utilization of the HCP handbook, incorporating program experience through the National Academy of Sciences (NAS) review, creation of objectives from biological data collected by the program, and information development through a multi-part Work Group process. While members of the Science Committee are not necessarily experts on best practices for HCP Goal and Objective development, we understand the need to balance goal achievability and species protection. Further, the hypotheses are sound that species populations will continue to remain similarly protected if environmental conditions and population responses measured over the past 23 years are maintained into the future. As was reiterated several times during the March 7 meeting: the rationale for proposed BGOs was that they be specific, measurable, and achievable.

The data-derived hypotheses developed within this rationale provide a more suitable, rigorous approach from existing, often best-guess parameters.

Some individual topics for consideration discussed at the March 7 meeting:

Data Collection:

The program must ensure that the biological and water quality monitoring programs are compatible with the proposed BGOs to allow for a proper evaluation of the metrics described in the memorandum.

Springflow:

In suggesting revisions to the springflow goals/objectives, the permit renewal team considered the same stressors that were considered during the development of the original goals. Namely, connectivity along Spring Run 3/Western Shoreline areas of the Comal springs system, and maintaining suitable water quality conditions for the recruitment of fountain darters during the most extreme low flows. The proposed goals are similar to the existing goals in that they identify minimum, intermediate, and long-term objectives. Additionally, the revised goals remove (to the extent currently possible) the ambiguity that is present in the interpretation of the existing springflow goals.

The same uncertainty present during the original objectives' development persists concerning the impacts of the minimum flows given we have not experienced them in real time; however, the proposed springflow objectives appear as protective or more protective than the existing springflow objectives. Springflow discharge for minimum, 1-year, 3-year, and 30-year flows are all equal to or greater than are found in the original goals.

Comal Springs Riffle Beetle (CSRB):

While it is noted that BGOs for CSRB (similar to other species) incorporate a more systematic approach, the Science Committee recommends the permit renewal team consider results from the ongoing CSRB population assessment in finalizing their objectives for this species. This multi-year project may provide new information to craft better objectives, with the caveat that the current drought conditions will not negatively affect recommended population means.

Water Quality:

The Science Committee agrees with the sentiment that water quality monitoring is an integral part of the EAHCP. No new information has been presented to the Committee on the short or long-term biological effects of temperatures exceeding 25C, which serves as the threshold for the current criteria. According to data presented by Dr.

Furl at the March meeting, temperatures regularly range from 25-27C during low-flow periods (2014 and 2023 used as examples). This is within the range of the proposed temperature criteria. At a minimum, staff should evaluate the health of the fountain darters in coming years when known temperatures range from 25-27C to further examine whether this is a protective range.

San Marcos Salamanders:

Shortcomings in the monitoring program described by the National Academies and Salamander BGO workgroup suggest the EAHCP focus efforts on developing a quality, robust monitoring program that provides meaningful results for this species during the next iteration of the permit. The Science Committee recommends that a better description of 'quality habitat' be included in the BGO chapter of the HCP since this is suggested as the measure for the objective as opposed to a population count. Furthermore, because the size of quality habitat can be directly managed and manipulated by staff (unlike abundance targets), the Science Committee suggests that a larger, less conservative goal be considered.

Texas Wild-Rice (TWR):

Given its poor utilization by fountain darters and prolific footprint, the Permit renewal team should consider developing a maximum coverage number for TWR. Not all Science Committee members thought this was a necessary addition to the BGO, but still supported the investigation for the next HCP.

Appendix | **Additional Comments Received from Science Committee Members**

Document: EAHCP Science Committee Commentary on the Proposed Biological Goals and Objectives Under Consideration for Permit Renewal.				
Science Committee Member: Chad Norris				
Document	**Page # or Section**	**Line # or Subject**	**Science Committee Member**	**Reviewer Comment**
SC BGO Response Memo	p.1/3; Intro	12-14	Chad Norris	I feel like this is misleading because the Science Committee was not part of the "process". The Science Committee was not formally asked to provide comments on the BGO memo as a group. Furthermore, there was also no formal request for the SC to review the revised BGO memo, rather we received the revised BGO memo on March 7th and were asked to comment on this short summary of the March 7th meeting, not the revised memo itself. I believe members of the IC committee requested to have the SC formally review the BGO memo, which does not appear to be happening.
SC BGO Response Memo	p.1/3; Intro	31-34	Chad Norris	This is not incorrect, but it is also not the same as the conditions anticipated under the BGOs, which would represent lower flows for a significantly longer time period. The flow-related responses of covered species populations observed between 2000-2022 cannot be used to say flows lower then we observed are protective of the species. There is no data to back up such an assertion. This should be clarified.
SC BGO Response Memo	p.2/3; Springflow	16	Chad Norris	I brought up the point that we are assuming discharge will remain at SR3 and the Western shoreline at 45 cfs. We do not have data at these low flows and this is a HUGE assumption based on limited flow split data. Chad presented the fitted predictions of discharge by area and that showed SR3 could be as low as 0.95 cfs at 45 cfs total and 0 at 30 cfs total. Again, this is a prediction and I am not confident there would be any flow in SR3 between 45 and 30 cfs every time we reach those levels. I do not see this comment captured in the document.
SC BGO Response Memo	p.2/3; Springflow	17-18	Chad Norris	This was specifically to maintain water quality at low flows within the Old Channel ERPA section.
SC BGO Response Memo	p.2/3; Springflow	18-22	Chad Norris	I feel like comparing the new goals to the old goals Is not the right approach. I believe the review of the goals should focus on whether or not they are protective of the species in the short and long-term. The criticisms of the first BGO memo that compared the new BGO's to old BGO's were more about the difference in analysis used as compared to the first EAHCP – the shorter time frame that included management under the current ITP, the lack of drought of record comparison, and the differing presentation of analysis as compared to the first round.
SC BGO Response Memo	p.2/3; Springflow	26-27	Chad Norris	It was discussed that we have not truly seen if 30 and 45 cfs in the Comal system are protective of the species as we have not seen flows at these levels in a pattern reflective of the proposed springflow regime. Eleven months at 45 cfs is much different than a month or two at 50-60 cfs, which is the lowest flows we observed in the system. Given the short lifespan of the CSRB, this is still a major concern. Again, this was discussed at the meeting and is not captured in this memo.
SC BGO Response Memo	p.2/3; CSRB	34-36	Chad Norris	If there is information learned from this work that brings the current BGOs into question, we should act on that information to adaptively manage and not continue to kick the can down the road. This was mentioned and seemingly supported by other SC members and is not captured in this memo.

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Science Committee Member: Jack Sharp				
Document	**Page # or Section**	**Line # or Subject**	**Science Committee Member**	**Reviewer Comment**
Revised BGO Memo	p.5-6/80	Figure 1	Jack Sharp	Fig.1, This is a good figure, I recommend a similar figure for the San Marcos system (also showing the location of gages #08170000 & #08170500) be included immediately after this figure.
Revised BGO Memo	p.5-6/80	Figure 1	Jack Sharp	Gage #08168710 is not shown on this or any other figure. This must be rectified.
Revised BGO Memo	p.5-6/80	Springflow Objectives	Jack Sharp	The rationale on why flow conditions for #08168710 were used to quantify spring flow, and not #08169000, needs to be clearly a stated here.
Revised BGO Memo	p.5-6/80	Springflow Objectives	Jack Sharp	Why is the Old Channel station omitted? Show its location also on Fig.1.
Revised BGO Memo	p.9/80	Springflow Objectives	Jack Sharp	similar to the above comment, what is the rationale on why flow conditions for #08170500 were used to quantify spring flow, and not #08170000, must be clearly stated here.
Revised BGO Memo	p.11/80	Springflow Objectives; LOESS statistics	Jack Sharp	LOESS should either be very briefly defined in the caption or cite the appropriate reference (perhaps Cleveland and Devlin, 1988), so that any reader can find out what it is and why it issued here.
Revised BGO Memo	p. 15/80	need San Marcos map	Jack Sharp	these locations should be shown on the first San Marcos Figure (see note on p. 5&6 above).
Revised BGO Memo	p. 19/80	LOESS statistics explaination	Jack Sharp	be consistent – use LOESS in the caption.
Revised BGO Memo	p. 21, Fig 9	Figure 9; CSRB	Jack Sharp	a table or reference to an Appendix is needed.
Revised BGO Memo: Attachment 1 Comment Response	p. 24 and p. 16 of 19	SM Salamander Diversion Springs	Jack Sharp	Comments Response, Diversion Springs are listed, but aren't shown on any figure. Put their location on Fig 8 (?) and/or a new Figure (after Fig. 1 - see comment above).
Revised BGO Memo	p. 27	Figure 12; need San Marcos map	Jack Sharp	this figure has no number or caption. Also, Sewell Park and Hopkins could be shown on Fig 8 or (?) and/or a new Figure (after Fig. 1 - see comment above) and/or the caption could refer to Fig.13.
Revised BGO Memo	p.44, Figure 1	Objective 1.1; Figure 1	Jack Sharp	the goal is to maintain specified flows at #08168710, again this gage location needs is shown on the appropriate figures.
Revised BGO Memo	p. 45	Objective 4.1; Monitoring Revisions	Jack Sharp	why must the biological monitoring program be revised? Add a few sentences on why the revision is needed and how it is planned to be revised.
Revised BGO Memo: Attachment 1 Comment Response	p. 10 of 19	Springflow	Jack Sharp	it would seem that if there was a significant non springflow component to the waters in Landa Lake or Spring Lake then faunas other than the fountain darter might be affected.

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Science Committee Member: Conrad Lamon

Document	Page # or Section	Line # or Subject	Science Committee Member	Reviewer Comment
SC BGO Response Memo	p.2/3; Data Collection	6-10	Conrad Lamon	I believe there needs to be a clear definition of the conditions and procedures that are used to determine “attainment” and “non-attainment” of the Biological Objectives proposed in the memo.
Revised BGO Memo	p.7/80	Table 1	Conrad Lamon	Table 1 - The authors state that z-transformation of the 30 day average predictor values was done to aid in interpretation of coefficients. These coefficients cannot be used with the predictor values showed in figure 2. Show transformed predictors on graph or transform the coefficients for presentation, and interpretation. Think about the units of the coefficients. If you only centered and don't z-transform, the units are cfs spring per cfs gauge. The values used in the transformation would be useful in order to use the coefficients of table 1 to make predictions. For instance, from the graphs in Figure 2, if one wishes to calculate the predicted value of Station discharge given a 30 day spring flow average of about 220 cfs at Upper Spring Run : 13.43+ 10.20 (220 cfs) is not equal to about 13 cfs. A last word on the coefficients: Show coefficient uncertainty with a 95%CI, not +/-1sd, and definitely not at all as in the 3 9 draft, so we may then interpret the coefficients.
Revised BGO Memo	p.7/80	Table 1	Conrad Lamon	Also show table of summary statistics for the predictors and response, including sample sizes , for each “station” and overall. For both the “training” and “test” data used here.
Revised BGO Memo	p.7/80	Table 1	Conrad Lamon	I'm not sure that a RMSE of ~5 (units are cfs) fully qualifies as “High performance” (page 4).
Revised BGO Memo	p.7/80	Table 1	Conrad Lamon	Using +/- 1 standard error is not standard practice. Why not build a confidence interval? Why not 90 or 95 % CI? Why not show confidence intervals for coefficients presented, which is also generally considered standard practice.
Revised BGO Memo	p.7/80	Table 1	Conrad Lamon	Unclear why a 3 year moving average was used, and exactly how it was used. The predictor variables needed to use the model today won't be available until 18 months from now, when the second half of the three year window of flow data is realized.
Revised BGO Memo	p.9/80	Table 2	Conrad Lamon	Why are there no uncertainty bounds presented for the 0.00 (2 significant digits?) value reported as “Predicted Values (+/- 1 sd)” for Upper Spring Run , Spring Runs 1 and 2? Is it because these predictions are out of the range of observed data? Why not present a tabular summary of the data used, including sample sizes by location (station)? Since the authors persist in this extrapolation of a linear model, it may behoove us to see data plotted as points on the Figure 2 plots, to determine just how far we are extrapolating, and to allow for detection of systematic lack of fit, that may indicate nonlinearity of the relationship near zero station discharge.
Revised BGO Memo	p.22/80	Table 4; "trends"	Conrad Lamon	Table 4 – is discussed in the text and caption as depicting “trends”, when actually it depicts a default window width LOESS fit to the annual average data. Not sure who needs to hear this again from me, but “default loess fitting is not a trend assessment.” As stated in reference to Figure 4 (and others) from my original written comments :“All these figures claim to show trends, but trend assessment was not performed in any formal way. These figures do not show trends, but fitted LOESS smooth functions of the data, after the daily data have already been aggregated once by year. As such, they will invite a good deal of “bump hunting” from the reader, a purpose for which they are not well suited, due to lack of a “universal” error estimate. For this reason it is a good idea to include the “pointwise” uncertainty estimates associated with the loess estimates on the plots, so the reader does not “see” bumps that are highly uncertain. Edge effects are also a known feature of smoothers, and loess is no exception. Inclusion of uncertainty bounds would show this added uncertainty near the edges, which is often the portion of the graph that holds the most interest to managers. Are these Loess curves with default settings for the window width (“span” in loess terminology)? The span or window width is the most important feature of non parametric smoothers, and indeed it's adjustment leads to a family of smoothes. Need to justify the choice of span.”
Revised BGO Memo	Overall	Tables 3, 4, 6; Use of Mu and Sigma	Conrad Lamon	These are not parameters from a normal distribution. The mean and Sd are sample quantities. The distribution of CSRB abundance is not nearly normal. Mu and sigma are population parameters and are therefore unknown (unknowable by frequentist rules), use our estimates of the true parameters, xbar and s.
Revised BGO Memo	p.59/80	Comal Springs Objective	Conrad Lamon	If “...the main goal is modeling for prediction.” (page 50), then centering should be enough, because z transformation was done, at least in part, to facilitate “ interpretation of model coefficients (Gelman and Hill)”. I notice convergence was also raised as an issue, which may be due model mis-specification, software specific issues, small sample sizes. I would like to know about model convergence, since the authors mention it. Seeing the model equations, declaration of software used, and data summary tables by station and overall would go a long way to determine the source of the convergence issued, the the exclusion of the Old Channel station makes me favor model mis-specification, when combined with the authors reference to a varying intercept model as the “null”. The null model here is the constant intercept model. Providing AIC for the null and Models 1-3 would facilitate a model comparison.without AIC on null Models 1-3
Revised BGO Memo	p.59/80	Comal Springs Objective	Conrad Lamon	While it may be that the level of detail needed to answer my questions is beyond the scope of the memo, fine. But my questions have answers and I would like to know what they are and when the could be made available to me. I was quite surprised that not even a summary of data was provided to improve the presentation in the new draft.
Revised BGO Memo	p.59/80	Comal Springs Objective	Conrad Lamon	The current draft gives short shrift to extrapolation involved in the application of a linear model. Inclusion of partial residuals on the prediction plots (data) of Figure 2 would provide an idea of how far the extrapolation goes for each station, and allow for detection of systematic lack of fit that may occur as station discharge approached zero.

Revised BGO Memo	p.59/80	Comal Springs Objective	Conrad Lamon	I appreciate the attempt at model comparison (1,2,3) and clarification for my benefit in section 3.2 , however, a) there are still no sample sizes, b) fit statistics for only the best fitting model is not a model comparison, and in fact the AIC only has meaning when compared to that of competing models. Table-ize fit stats for true null model and the models 1-3, in fact, adding all the combinations (for instance, varying intercept, fixed slope?) would be in the full spirit of a model search. c) The claim the the selected mlm is " reliable for predicting station-level discharge" is too broad, and should be qualified, as the fit statistics are only applicable within the range of the data used to fit the model, and, d) the used of the terms training and test are not quite as I have understood them in the past. A true test dataset is comprised of observations withheld from the (training) data used to fit the model, not selected as a random sample from the training data. This is likely the reason that the RMSE's are so close, as my experience with other studies leads me to think that a doubling in RMSE would not be unlikely
Original and Revised BGO Memo	Overall	30 day rolling average	Conrad Lamon	Is the "30 day rolling average" centered on the "monitoring events"? Describe and summarize the data used in text, table and graphical form. For use in a predictive model (later comments), you would want a 30 day period prior to "monitoring event" because you can't predict using a 30 day average centered on today, as only half of the data have been observed. A better explanation is needed to justify the use of a the "rolling average" in lieu of instantaneous measurements.
Original and Revised BGO Memo	Overall	Model formula	Conrad Lamon	Show model form (formula), define units for station discharge (and describe the sampling involved in previous paragraph), provide sample sizes by location and most will be answered. Was the Old Channel station taken as a reference station? Model formula(e) would let us know.
Original and Revised BGO Memo	Overall	Statistics: extrapolation	Conrad Lamon	Extrapolation is to be avoided with regression models. This is the reason we should always summarize the data used to fit the models, to avoid their use outside of this range. Use of the historical record could serve to increase the sample size and include observations in the range of interest. the range needed.